

Whether to Collaborate?

Coding for Cooperation in Wireless Fading Environments

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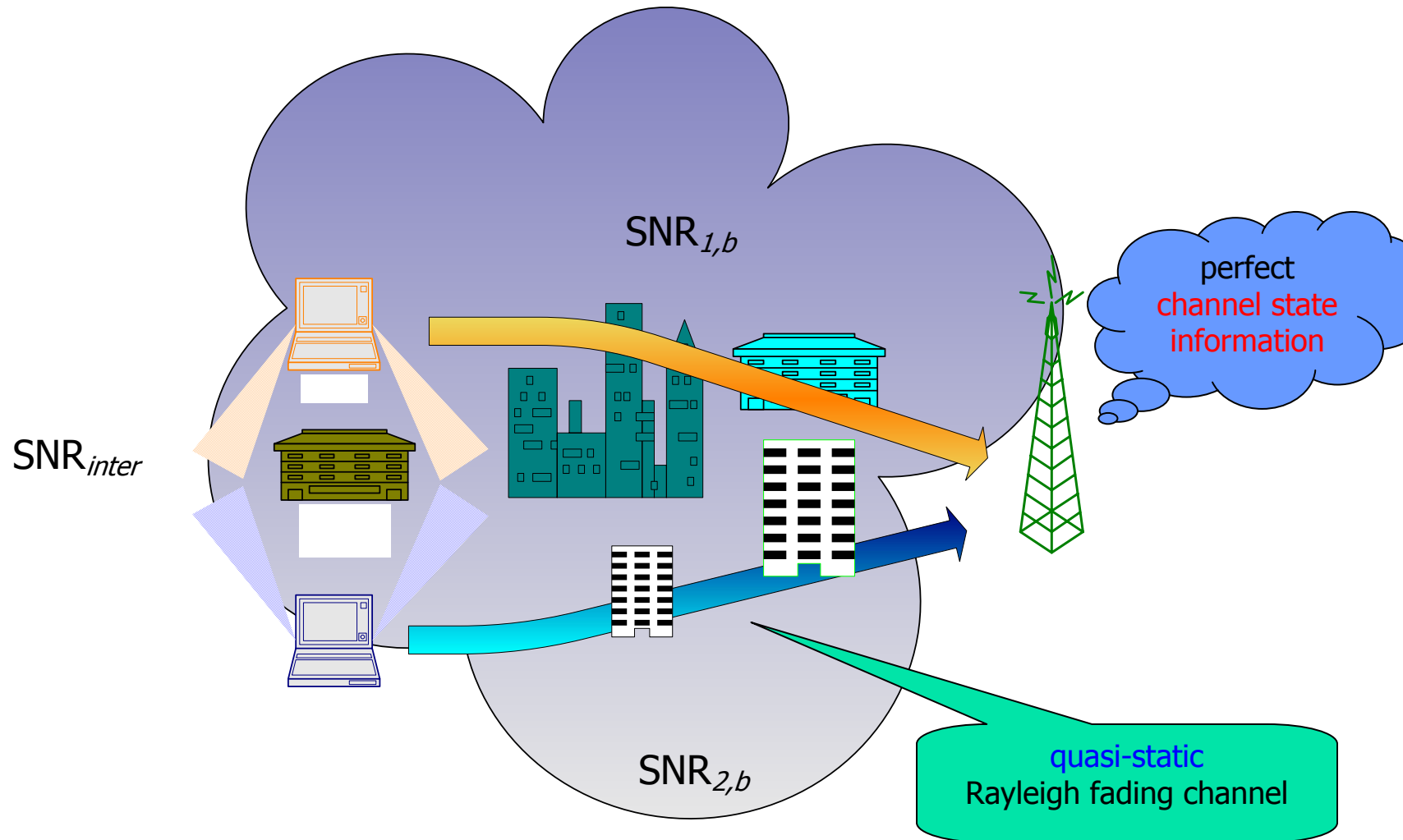
(joint work with Ruoheng Liu and Emina Soljanin)

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Cooperation and Property Exchange

- **Cooperating users** have **own information** to transmit, but could **help each other**, instead
- **User property**: transmit power and bandwidth
 - **Requirements**: error rate, delay, throughput
- **Property exchange**: Should one **use own power and bandwidth** to **satisfy** someone else **requirements**?

Two Cooperating Users



Two stage property exchange protocol

- Broadcast stage: listen to partner's 1st transmission to the destination
- Cooperative diversity stage (2nd transmission):
 - “I will give you as much bandwidth and power as you give me, whenever we can understand each other's 1st transmission.”
 - If we can not understand each other let's send own information, instead.
- **Benefit?** Why transmit someone else's information if one has better average SNR?

Cooperation Benefit: Reliability...

- Wireless communications

Reliable transmission

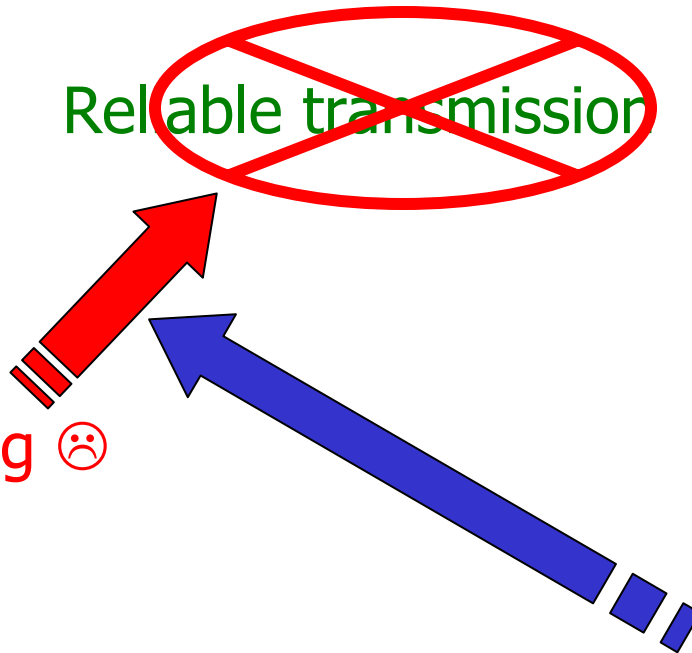


- *Error rate $\sim \text{SNR}^{-1}$*

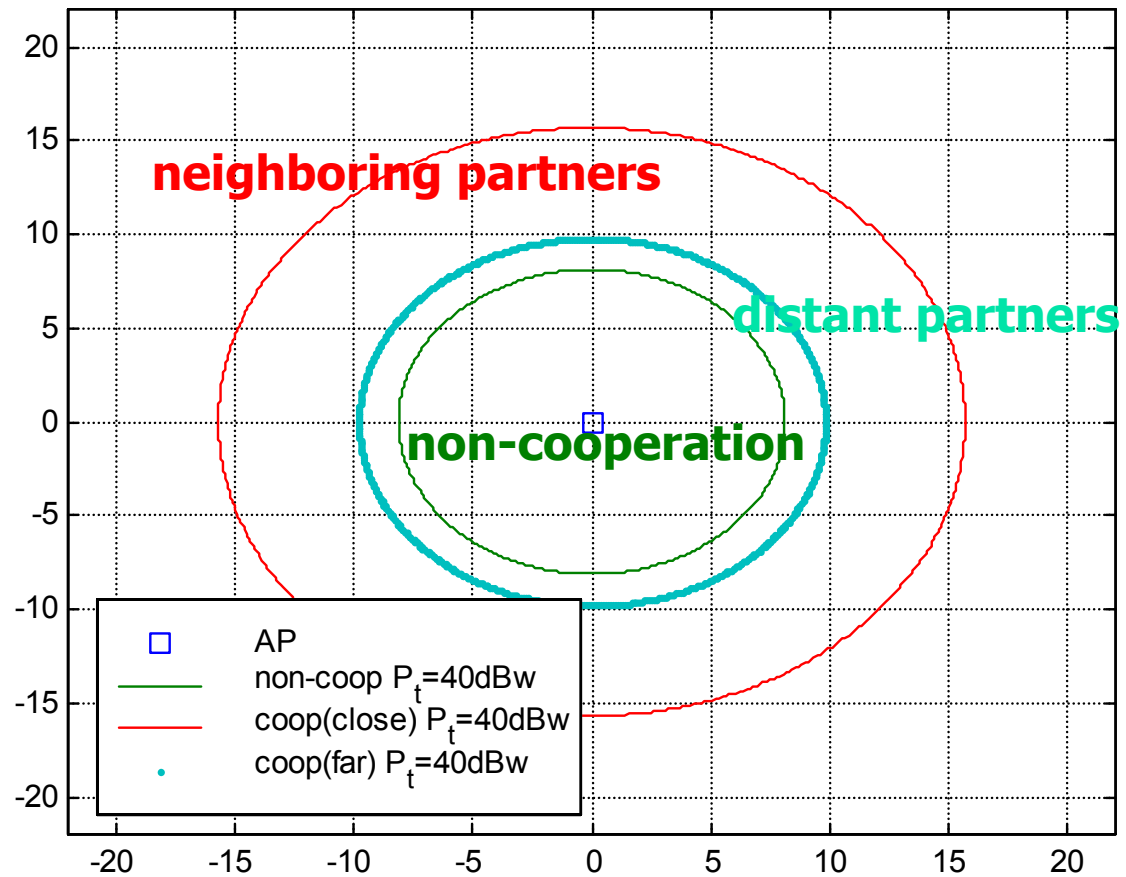
- *Error rate $\sim \text{SNR}^{-2}$*

Deep fading ☹️

Diversity 😊



Average Coverage under Coded Cooperation



Results & Ongoing work

- coding for cooperative diversity
- M-user cooperative diversity and protocols
- cooperative multi-hopping
- spectral efficiency
- non-Rayleigh channel models